



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 442 712 B1

(12)

## EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention  
of the grant of the patent:  
17.05.2006 Bulletin 2006/20

(51) Int Cl.:  
*A61B 17/15 (2006.01)*

(21) Application number: 04250464.7

(22) Date of filing: 28.01.2004

### (54) Universal alignment guide

Universell einsetzbares Werkzeug zum Ausrichten

Guide d'alignement universel

(84) Designated Contracting States:  
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IT LI LU MC NL PT RO SE SI SK TR

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(43) Date of publication of application:  
04.08.2004 Bulletin 2004/32

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(56) References cited:  
EP-A- 0 469 966 EP-A- 0 490 812  
WO-A-94/00066 US-A1- 2002 133 163

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**Description**BACKGROUND OF THE INVENTION

## 1. Field of The Invention

**[0001]** The invention relates to methods and instrumentation for use in preparing a bone surface for attachment of a prosthesis. More particularly, the invention relates to methods and instrumentation for aiding in the alignment and positioning of a resection guide relative to bone surfaces, in order to resect the bone surfaces and prepare them for attachment of endoprostheses. A common procedure in which this invention may be employed is knee arthroplasty.

## 2. Brief Description of The Prior Art

**[0002]** Joint replacement procedures, such as total knee arthroplasty, involve replacement of the load bearing surfaces of bones with artificial components. Proper implantation of these components, or implants, requires detailed measurements of the joint as well as accurate resections of the bone surfaces in preparation for their attachment to their respective components.

**[0003]** As used herein, when referring to bones or other body parts, the term "proximal" means closest to the heart, and the term "distal" means more distant from the heart. When referring to tools and instruments, the term "proximal" means closest to the practitioner, and the term "distal" means distant from the practitioner.

**[0004]** In attempting to duplicate the natural behavior of the joint, replacement components require specific positioning and attachment to the bones of the joint that they are to replace, in accordance with the detailed measurements. Commonly, since the bone-contacting surface of an implant, for example a distal femoral component, has a specific geometry, the bone to which it is to be attached must be accurately resected and shaped to mate with the geometry of the implant and provide the implant's proper alignment in the joint.

**[0005]** Measurement and placement of the distal femoral component, for example, requires determination of the following four orientations prior to implantation: proximal/distal, flexion/extension, varus/valgus, and internal/external rotation.

**[0006]** Various techniques and instruments are known for facilitating making these measurements and then resecting the bone surfaces accordingly. Examples of such are found in published United States Patent Application numbers 20020133160, 20020133161, 20020133162 and 20020133163, as well as United States Patent Application serial number 09/974,524, entitled "Methods and Tools for Femoral Resection in Knee Surgery". These applications teach an alignment guide coupled to a bone anchor that is attached to the distal femur. The alignment guide is also joined to a resection guide via an attachment rod. Orientation and locking of the resection

guide is done via three cam locks on the alignment guide. One cam lock is for adjusting and locking varus/valgus orientation, another is for flexion/extension, and a third is for proximal distal orientation of the resection guide relative to the distal femur. This alignment guide is therefore designed for independent locking of three orientation positions of the resection guide. Removal of the resection guide and attachment of further instruments would provide additional positioning capabilities.

**[0007]** Recently, various computerized systems have been introduced to aid the practitioner during different surgical procedures. These systems include multiple video cameras which are deployed above the surgical site and a plurality of dynamic reference frame (DRF) devices, also known as trackers, which are attached to body parts and surgical instruments. The trackers are generally LED devices which are visible to the cameras. Using software designed for a particular surgical procedure, a computer receiving input from the cameras guides the placement of surgical instruments.

**[0008]** Additionally, computer-assisted surgery has been developed which utilizes a tracking system that can relate positions on the patients and/or instruments to stored X-ray, CT scan and MRI data previously obtained for the patient. More recently, image free computer-aided surgery has been utilized where mechanical relationships can be calculated from anatomical reference points such as in joint arthroplasty. These systems are used intra-operatively for performing various surgical procedures, including replacement of artificial joints.

**[0009]** It has been especially useful to utilize trackable medical instruments for use in procedures utilizing computer-assisted image guided or image free medical and surgical navigation systems. Systems using body images are shown in U.S. Patent Nos. 5,383,454 to Bucholz and 6,021,343 to Foley et al. In general, these image-guided systems use computer stored digital images of a body part obtained, for example, by CT scans taken before surgery, to generate images on a display, such as a CRT monitor screen, during surgery. These images are used in connection with real time information for representing the position of a surgical instrument with respect to the body part. The systems typically include tracking devices such as, for example, a tracker having LEDs and attachable to a surgical instrument as well as a patient's body part, a tracking array used in real time during surgery to track the position of the body part and the instrument via the tracker, and a monitor screen to display images representing the body and the position of the instrument relative to the stored images as the surgical procedure is performed.

**[0010]** An image-free type system is shown in U.S. Patent No. 6,385,475. Some systems of this type include virtual joint images. In such systems, active or passive marker elements are attached to bones on opposite sides of a joint and a measuring device, such as an optical sensing camera coupled to a data processing system to which signals corresponding to the positioning data of

the marker elements is supplied by the optical camera system, is used to correlate the markers on opposite sides of the joint. With a pointer mounted tracker, it is possible to locate various anatomic reference points on the joints to allow the system to position a cutting instrument such as a reamer or saw blade.

[0011] The prior art instruments used for determining the correct orientations for tibial and femoral resection in total knee arthroplasty, for example, leave room for optimization with respect to their designs, interaction with computer-assisted surgery instrumentation, as well as speed and ease of use.

#### SUMMARY OF THE INVENTION

[0012] It is an object of the present invention to provide an instrument which facilitates the determination and setting of numerous desired alignment orientations respective to a bone. With reference to a distal femur, for example, these are referred to as proximal/distal, flexion/extension, varus/valgus, and internal/external rotation. Those skilled in the art will recognize that comparable movements and orientations on other bone segments, although termed differently, will be similarly facilitated by the present invention.

[0013] It is also an object of the present invention to provide an instrument which facilitates the determination and setting of numerous desired orientations simultaneously, rather than sequentially.

[0014] It is yet another object of the present invention to provide an improved instrument design that offers greater speed and ease of use.

[0015] These and other objects are achieved by the present invention, which is a universal alignment guide for positioning an instrument with respect to a bone.

[0016] In the preferred embodiment, the alignment guide is comprised of a spheroidal base and a collar associated with the base in such manner as to facilitate universal motion of the collar with respect to the base. The base is attached to one end of a bone anchor, the bone anchor being set in a bone at its other end. It is noted that the spheroidal base need not be a full sphere, but only enough of a structure to facilitate the universal motion between the collar and the base, as described herein.

[0017] In a second embodiment, the collar, rather than the base, is associated with the bone anchor, leaving the base free to move with respect to the collar. With regard to this embodiment, the description of features of other embodiments, as well as the preferred embodiment, may be similarly incorporated into this second embodiment.

[0018] It is noted that the bone anchor may be set at any convenient location on any desired bone. For example, the anchor may be set medially or laterally on the distal femur, or on the humeral head. Advantageously, the anchor is positioned so as to facilitate unencumbered positioning and use of the alignment guide and resection guide, as well as any other instruments, trial components,

and implants. Also advantageously, the anchor is set 7,62cm (3 inches) from the end of the distal femur. Additionally, the anchor may be attached to the bone in a variety of ways commonly known to those skilled in the art. Some non-limiting examples of attachment are screwing, clamping or cementing the anchor to the bone.

[0019] In the preferred embodiment, a resection guide may be attached to the freely movable collar, for universal positioning with respect to the bone. Alternatively, in the second embodiment, the resection guide may be attached to the freely movable base for the same purpose. As commonly known to those skilled in the art, the resection guide is used to facilitate cutting the bone at desired orientations. The attachment and manipulation of other cutting guides and instruments, however, is also envisioned, and is encompassed generally by reference to the term resection guide, as used herein.

[0020] In the preferred embodiment, the collar is advantageously assembled from a top and bottom portion. These two portions are positioned so as to encapsulate the spheroidal base, and are then joined together. The preferred method of joining the two portions together is by shielded metal arc welding (SMAW). It is recognized, however, that there are many other methods, techniques and designs to facilitate joining the two portions of the collar together.

[0021] In the preferred embodiment, the base contains a through bore, or passage, for cooperative assembly with one end of the bone anchor. In a third embodiment, not shown, the passage terminates inside the base, rather than penetrating all the way through. In the second embodiment, the collar contains at least one passage for cooperative assembly with one end of the bone anchor.

[0022] In the preferred embodiment, once the bone anchor is inserted into the passage in the base, in order to lock the base against the bone anchor, a threaded slot in the base, together with an accompanying fixator, or set screw, are provided. The slot intersects with the passage, and the set screw is forwarded through the slot until it abuts the bone anchor, thus stabilizing and locking the base in position against the bone anchor. An opening, or window, is further provided in the collar of the alignment guide to allow additional access to the set screw. In the second embodiment, this is similarly accomplished, except with the bone anchor being inserted into a passage in the collar.

[0023] In the preferred embodiment, on the portion of the base facing the bone, is a flattened surface to enable closer positioning of the base, and consequently, the alignment guide, to the bone.

[0024] Further in the preferred embodiment, the collar contains a motion governor which facilitates locking the collar against the base once the desired position of the collar relative to the bone has been selected. The motion governor is made up of an actuator, or threaded knob, and a threaded aperture in the collar. Preferably, the threaded aperture is located in a protrusion on the collar. Among other advantages, the protrusion provides added

surface area to the aperture for increased threaded engagement between the knob and collar. The second embodiment contains similar structure.

[0025] In the preferred embodiment, locking of the collar against the base is accomplished in the same manner as locking the base against the bone anchor. That is, the threaded knob is advanced through the aperture in the collar until the knob abuts the base and locks the collar in position against the base.

[0026] In the preferred embodiment, the alignment guide further contains a resection guide. The resection guide has two attachment rods which slidably engage two channels in the collar. It is possible, however, that the resection guide, or any other attaching instrument, may be coupled to the alignment guide via at least one area of contact.

[0027] Preferably, the channels and rods of the resection guide have rounded circumferences, however, any geometry may be implemented. Also preferably, the channels are located in protrusions on the collar, which provide added material to the collar to support assembly and interaction with the resection guide.

[0028] In the preferred embodiment, each of these protrusions on the collar also contains at least two threaded bores. On each protrusion, the bores are oriented at ninety degrees to each other as well as to the channel. Each bore accepts an arrestor, or threaded knob. It is also envisioned, however, that a protrusion may have at least one bore, and that the angularity of a bore relative to either another bore, or to a channel, may be other than ninety degrees.

[0029] In the preferred embodiment, upon insertion of both attachment rods of the resection guide into the respective channels in the collar, each one of two knobs, when advanced through a selected bore on oppositely oriented protrusions of the collar, is used to lock the resection guide in place. It is noted that having two bores oriented at ninety degrees to each other on one protrusion, advantageously provides an additional angle of insertion of the knobs for locking the attachment rods of the resection guide against the collar.

[0030] The preferred method of using the present invention includes attaching a bone anchor to a bone such as a femur or humerus, coupling the base of the alignment guide to the bone anchor, locking the base against the anchor to prevent its movement with respect to the bone, attaching a resection guide to the collar, orienting the resection guide relative to the bone by movement of the collar relative to the bone, and fixing the desired position of the resection guide by locking the collar against the base with an actuator and locking the resection guide in the collar with arresters.

[0031] With reference to the distal femur, and without regard to the particular instrument attached to the alignment guide, in the preferred embodiment, the orientations of flexion/extension, varus/valgus and internal/external rotation are accomplished by moving the collar relative to the base. Proximal/distal orientation is accom-

plished by moving the resection guide relative to the collar.

5 [0032] It is preferable to first set all of the desired orientations and then lock the collar and resection guide in place. However, locking the collar and resection guide sequentially is also possible.

10 [0033] The present invention may be used by itself, or in conjunction with other navigational equipment such as a computer-aided surgery system using an optical tracking system mounted on the instrument, which aids in the location and positioning of various resection planes relative to a bone.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 [0034] In the drawings, wherein similar reference characters denote similar elements throughout the several view:

20 FIG. 1 is an exploded view of the universal alignment guide attached to a resection guide, where the base is attachable to a bone anchor implanted at one of its ends in the distal femur.

25 FIG. 2 is a perspective view of the side of the universal alignment guide facing the distal femur, with a resection guide attached.

FIG. 3 is an exploded view of the rear section of the universal alignment guide cut away along lines 3-3 of Fig. 1.

30 FIG. 4 is a frontal section view of the alignment guide cut away along lines 4-4 in FIG. 1.

FIG. 5 is a perspective view of a first alternate embodiment of the universal alignment guide where the collar is attachable to the bone anchor.

35 FIG. 6 is a side view of a lateral cutting block used in conjunction with the lateral approach for knee replacement surgery.

FIG. 7. is a perspective view of the alignment guide, lateral resection guide, and tracker in a lateral orientation with respect to the knee joint.

40 FIG. 8. is a perspective view of a set of variously sized lateral cutting blocks.

#### DETAILED DESCRIPTION

45 [0035] Referring to FIGS. 1 and 2, there is illustrated the preferred embodiment of the universal alignment guide of the present invention, generally denoted as 10, with a bone resection guide 50 attached. The alignment guide is positioned over a bone anchor 60 that is implanted into the distal femur 70.

50 [0036] Initially, bone anchor 60, having a first end 61 and a second end 62, is implanted at its first end 61 into the anterior portion of distal femur 70. In the preferred embodiment, the configuration of second end 62 of bone anchor 60 includes a cross-bar 63 which engages a slot 21a in passage 21 of spheroidal base 20, and facilitates proper mating with alignment guide 10. Additionally,

cross-bar 63 serves as an attachment point for a tracker 300, as shown in FIG. 7. It is recognized that various other designs of second end 62 of bone anchor 60 may suffice for these purposes.

[0037] Referring to FIG. 2 where the side of alignment guide 10 facing distal femur 70 is depicted for better visibility of structures, alignment guide 10 has a spheroidal base 20. Base 20 has an outer spherical surface 20a and a diameter of preferably 2.54 cm (1 inch), although other dimensions are envisioned. Base 20 also has an advantageously flattened surface 22 on the side facing distal femur 70 to allow it to be positioned closer to the bone. It is noted that base 20 need not be a full sphere, but only enough of a structure to facilitate the universal motion between collar 30 and base 20, as described herein.

[0038] In the preferred embodiment, base 20 has passage, or bore, 21 into which bone anchor 60 is inserted. In an alternate embodiment, not shown, passage 21 may terminate inside base 20. In the preferred embodiment, passage 21 has a cross-slot 21a such that it will accept and mate with cross-bar 63 of second end 62 of bone anchor 60. Base 20 further has a threaded slot 23 which is oriented on base 20 so that it intersects passage 21. Once the second end 62 of bone anchor 60 is inserted into passage 21 in base 20 of alignment guide 10, a fixator, or set screw 24, is threaded into slot 23 and advanced until it abuts bone anchor 61 in passage 21. Tightening of set screw 24 against bone anchor 60, secures base 20 against bone anchor 60.

[0039] In the preferred embodiment, alignment guide 10 also has a collar 30 that partially encapsulates base 20, thereby facilitating universal motion of collar 30 with respect to base 20. As seen in FIG. 3, collar 30 is formed of two halves that are joined together. The inner surfaces 31a and 32a of collar 30 match the outer spherical surface 20a of base 20 for sliding engagement therewith. Top portion 31 and bottom portion 32 are initially positioned on either side of base 20, brought into contact with each other, and then welded by shielded metal arc welding (SMAW). It is understood that there are many other variations and configurations possible for assembling collar 30 around base 20. Additionally, it is noted that collar 30, advantageously has a window 47 that provides added access to slot 23 in the base 20 for adjustment of set screw 24 in slot 23.

[0040] Referring to FIGS. 2 and 3, in the preferred embodiment, collar 30 has three protrusions 34, 35, 36. Protrusion 34 has one threaded opening, or aperture, 37 leading to base 20, while protrusions 35 and 36 each have three orthogonal openings. More specifically, protrusion 35 has two orthogonal threaded bores 38 and 43, and channel 45. Similarly, protrusion 36 has two orthogonal threaded bores 39 and 44, and channel 46. Although depicted as a knob, or actuator, 40, threadably cooperating with bore 37, and knobs, or arrestors, 41 and 42, threadably cooperating with bores 38 and 39 respectively, it is understood that bores 37, 38, 39, 43 and 44 are similarly threaded and accommodate knobs 40, 41 and

42 interchangeably. In the preferred embodiment, knobs 40, 41 and 42 have textured knob heads 40a, 41a and 42a, and threaded shafts 40b, 41b and 42b. The use of protrusions 34, 35 and 36, as well as bores 37, 38, 39, 43 44, and knobs 40, 41 and 42 will be explained in more detail below.

[0041] As mentioned above, protrusions 35 and 36 contain channels 45 and 46 that penetrate protrusions 35 and 36 respectively. These channels 45, 46 are designed for engagement with resection guide 50.

[0042] Resection guide 50 has first and second attachment rods 51 and 52 which slidably engage respective channels 45 and 46 in protrusions 35 and 36 of collar 30. It is recognized that although the cross-sections of channels 45, 46 and rods 51, 52 are round, any interactive shapes and configurations are possible. Resection guide 50 also includes rotatable pin guides 50a and 50b to facilitate joining other surgical instruments to resection guide 50, as well as attachment points 50c and 50d for use in connecting trackers, such as tracker 300 depicted in FIG. 7, to resection guide 50. Another embodiment of a resection guide is shown in FIGS. 6-8 as lateral resection guide 100, and will be discussed in more detail, below.

[0043] Protrusions 34, 35 and 36 provide added material to the collar for interaction with knobs 40, 41 and 42 of resection guide 50. However, it is also envisioned that collar 30 may be made without protrusions by uniformly having more circumferential material to support and interact with knobs 40, 41, and 42 and resection guide 50.

[0044] In operation, once rods 51, 52 of resection guide 50 are inserted into their respective channels 45, 46, knobs 41 and 42 are used to lock resection guide 50 in place. This is done, for example, by threadably advancing knob 41 through bore 38 until knob 41 abuts rod 51 of resection guide 50 within protrusion 35, thereby locking resection guide 50 in place with respect to collar 30. Although it is recognized that one knob will lock resection guide 50 in place, preferably, a second knob, 42 can also be threadably advanced through bore 38 until it abuts rod 52 in channel 46, thereby more securely locking resection guide 50 to collar 30 of alignment guide 10. It is further recognized that resection guide 50 may have only one attachment rod, and be attached and locked to collar 30 via only that rod.

[0045] Referring to FIGS. 1, 2 and 4, on protrusion 35, bores 38, 43, and channel 45 are oriented at ninety degrees to each other, and on protrusion 36, bores 39, 44 and channel 46 are similarly oriented at ninety degrees to each other. The purpose for additional bores 43 and 44 is to afford additional angles of engagement of rods 51 and 52 of resection guide 50 by knobs 41 and 42. This is useful, for example, when intraoperatively, there may be insufficient room, or it may be inconvenient, for inserting knob 41 through bore 38. Consequently, knob 41 may be alternatively inserted through bore 43 to lock the resection guide 50 in place.

**[0046]** The components of alignment guide 10 are preferably made from surgical grade materials. In the preferred embodiment, base 20, collar 30, set screw 24 as well as knob heads 40a, 41a, and 42a and knob shafts 40b, 41b, and 42b are made from surgical grade stainless steel. Other surgical grade materials, as well as disposable materials are, of course, also envisioned.

**[0047]** In conjunction with the preferred embodiment depicted in FIGS. 1-4, the following is the preferred procedure for using universal resection guide 10. Although illustrative, it is understood by those skilled in the art that these steps need not necessarily all be performed in sequence.

**[0048]** First, bone anchor 60 is implanted into the anterior surface of distal femur 70 approximately 7,62 cm (3 inches) away from the end of the distal femur. As mentioned previously, advantageously, the anchor is positioned so as to facilitate unencumbered positioning and use of the alignment guide and resection guide, as well as any other instruments, trial components, and implants associated with the desired surgical procedure. It is also recognized, and depicted in FIG. 7, that a lateral approach may be employed, wherein, in part, bone anchor 60 may be implanted in the lateral surface of the distal femur. This will be discussed in more detail, below.

**[0049]** Next, according to the preferred embodiment, alignment guide 10 is placed onto bone anchor 60 by means of aligning cross-bar 63 with slot 64, and sliding bone anchor 60 through passage 21 in base 20. Alignment guide 10 is then locked in position with respect to bone anchor 60 by threadably inserting and advancing a set screw 24 through slot 23 in base 20, until set screw 24 abuts bone anchor 60 to the extent necessary to prevent movement of base 20 relative to bone anchor 60. At this point, collar 30 is free to rotate about base 20.

**[0050]** Resection guide 50 is then attached to collar 30 by inserting attachment rods 51 and 52 into respective channels 45 and 46 in collar 30. Resection guide 50 may then be positioned relative to distal femur 70. As explained above, flexion/extension, varus/valgus and internal/external rotation are attributable to the movement of collar 30 relative to base 20. Proximal/distal orientation is attributable to movement of resection guide 50 relative to collar 30. To simultaneously fix the flexion/extension, varus/valgus and internal/external rotation positions of resection guide 50, with reference to FIG. 3, knob 40 is threadably advanced through aperture 37 in protrusion 34 of collar 30, until threaded shaft 40b sufficiently abuts base 20 to lock collar 30 in position relative to base 20. To then lock the proximal/distal position of resection guide 50, knobs 41 and 42 are threadably advanced through bores 38 and 39 respectively until threaded shafts 41b and 42b respectively, abut rods 51 and 52 of resection guide 50 and lock it in place relative to collar 30. Once the flexion/extension, varus/valgus, internal/external rotation, and proximal/distal orientations of resection guide 50 relative to distal femur 70 are fixed, further procedures known to those of ordinary skill in the art

can be carried out in the furtherance of resecting the distal femur 70. For example, surface 80 of guide 50 may be used to guide a saw to form the distal surface of femur 70.

**[0051]** FIG. 5 illustrates a second embodiment of the universal alignment guide, identified as 200. All other aspects of the preferred and second embodiments being similar, alignment guide 200 primarily differs from alignment guide 10 in that alignment guide 200 is attached to bone anchor 60 at collar 230. Collar 230 has passages 221 which are adapted to accept bone anchor 60. Notably, bone anchor 60 may be coupled to either passage 221 on collar 230 and locked in place. To lock collar 230 against bone anchor 60, a fixator 224, similar to fixator 24 of the preferred embodiment, is threadably engaged and advanced into a threaded slot 223 on collar 230, until fixator 224 abuts bone anchor 60 in passage 221.

**[0052]** In the second embodiment, resection guide 250, comparable to resection guide 50 of the preferred embodiment, is attached to the base 220 of alignment guide 200 via at least one attachment rod 255. Attachment rod 255 is fixedly joined to base 220 and slidably engaged by resection guide 250.

**[0053]** Flexion/extension, varus/valgus and internal/external rotation are attributable to the movement of base 220 within collar 230. In order to fix, or lock, these orientations, actuator 40 is threadably advanced through collar 230 in the same manner as in the preferred embodiment, until it abuts base 220 and locks it in position relative to collar 230.

**[0054]** Proximal/distal orientation is attributable to movement of resection guide 250 along attachment rod 255, relative to base 220. It is further recognized, however, that the single rod attachment to resection guide 250 also facilitates internal/external rotation. In order to lock resection guide 250 against rod 255, there is provided an arrestor 254 that threadably engages resection guide 250, and can be advanced until it abuts rod 255 and locks it into place.

**[0055]** With the exception of accounting for the above-enumerated differences in structure in the second embodiment, the procedure for using resection guide 200 is similar to that of the preferred embodiment. Bone anchor 60 is implanted into a bone, such as distal femur 70, in a variety of orientations such as either anteriorly or laterally. Alignment guide 200 is then set upon bone anchor 60 and locked in position by threadably inserting and advancing fixator 224 in slot 223 in collar 230 until fixator 224 abuts bone anchor 60 to the extent necessary to prevent movement of collar 230 relative to bone anchor 60. At this point, base 220 is free to rotate within collar 230. Then resection guide 250 is slidably set upon attachment rod 225.

**[0056]** To simultaneously fix the flexion/extension, varus/valgus and internal/external rotation positions of resection guide 250, actuator 40 is threadably advanced through collar 230 until it sufficiently abuts base 220 to lock collar 230 in position relative to base 220. To then lock the proximal/distal position of resection guide 250,

arrestor 254 is threadably advanced through resection guide 250 until it abut rod 255 and locks it in place relative to base 220. Once the flexion/extension, varus/valgus, internal/external rotation, and proximal/distal orientations of resection guide 250 relative to distal femur 70 are fixed, further procedures known to those of ordinary skill in the art can be carried out in the furtherance of resecting distal femur 70.

[0057] Referring to FIGS 6-8, there is shown another embodiment of a resection guide, particularly a lateral resection guide 100, that may be used with the universal alignment guide of the present invention. With reference to FIG. 6, lateral resection guide 100 has two attachment rods 110 and 112 that are similar to, and perform the same function as, attachment rods 51 and 52 of resection guide 50 in the preferred embodiment, in that they are to interface resection guide 100 with the alignment guide.

[0058] As opposed to resection guide 50, however, lateral resection guide 100 is intended for use in the lateral approach to knee replacement surgery, as depicted in FIG. 7. Specifically, this involves inserting bone anchor 60 into the lateral surface 74 of a bone such as the distal femur 70, as opposed to the anterior surface 72 as in the preferred and second embodiments. Notably, it is advantageous to insert bone anchor 60 approximately 7,62 cm (3 inches) from the end of the distal femur. Then, coupling alignment guide 10 or 200 to bone anchor 60, attaching lateral resection guide 100 to the alignment guide, and advantageously aligning it to the knee joint as known to those skilled in the art.

[0059] Lateral resection guide 100 provides five cutting guide surfaces to facilitate preparing the knee joint for replacement components. Specifically, lateral cutting guide 100 has an anterior cutting guide surface 130, an anterior chamfer cutting guide surface 140, a distal cutting guide surface 150, a posterior chamfer cutting guide surface 160, and a posterior cutting guide surface 170. Additionally, it has features 120, such as holes and slots, to facilitate marking its position and pinning it to bone 70. Because of various anatomical sizes of bones, lateral resection guide 100 may be provided in a variety of sizes, as shown in FIG. 8.

[0060] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention.

### Claims

1. An alignment guide (10) for positioning an instrument with respect to a bone, comprising a bone anchor (60) having a first end (61) being attached to a bone (70) and a second end (62); and a spheroidal base (20; 220) and a collar (30; 230); wherein said spheroidal base (20; 220) is attached to said second end (62) of said bone anchor (60); wherein said collar

(30; 230) is associated with said spheroidal base (20; 220) to facilitate universal motion of said collar (30; 230) with respect to said spheroidal base (20; 220) for positioning said instrument; wherein said spheroidal base (20; 220) contains a passage (21) for cooperative assembly with said second end (62) of said bone anchor (60), **characterized in that** the guide (10) furthermore comprises a motion governor to control motion of said collar (30; 230) relative to said spheroidal base (20; 220) and further comprises a resection guide (50; 250) attached to said collar (30; 230).

2. The alignment guide of claim 1, wherein said collar (30) contains at least one channel (45, 46), and said resection guide (50) contains at least one attachment rod (51, 52) for cooperative assembly with said at least one channel (45, 46).
3. The alignment guide of claim 2, further comprising at least one arrestor (41, 42; 254) to control motion of said resection guide (50; 250) relative to said collar (30; 230).
4. The alignment guide of claim 3, wherein said arrestor is a knob (41, 42; 254) having a threaded extension, and said collar (30; 230) contains at least one threaded bore (38, 39); said at least one threaded bore (38, 39) intersecting said at least one channel (45, 46) of said collar (30), and available for cooperative engagement by said threaded extension of said knob (41, 42), thus facilitating regulated contact between said knob and said at least one attachment rod (51, 52) of said resection guide (50) for controlling motion of said resection guide (50) relative to said collar (30).
5. The alignment guide of claim 1, further comprising at least one protrusion on said collar (30); at least one channel (45, 46) in said protrusion; said resection guide (50) containing at least one attachment rod (51, 52); and said at least one channel (45, 46) arranged for cooperative assembly with said at least one attachment rod (51, 52), and at least one arrestor arranged on said alignment guide to control motion of said resection guide (50) relative to said collar.
6. The alignment guide of claim 5, wherein said at least one protrusion (35, 36) has at least one bore (38, 39) oriented at 90 degrees with respect to said at least one channel (45, 46).
7. The alignment guide of claim 6, wherein said at least one arrestor (41, 42) comprises a knob head (41a, 42a) attached to a threaded shaft (41b, 42b), said shaft (41b, 42b) extending through said at least one bore (38, 39) into contact with said at least one attachment rod (51, 52).

8. The alignment guide of claim 1, wherein said passage (21) terminates inside said spheroidal base (20). (20; 220) umfasst und weiterhin eine Resektionsführung (50; 250), die mit besagter Zwinge (30; 230) verbunden ist, umfasst.

9. The alignment guide of claim 1, wherein said spheroidal base (20; 220) further contains a slot (23; 223) that intersects with said passage (21), and said alignment guide further comprises a fixator (24; 224) in cooperative assembly with said slot (23; 223) to stabilize said spheroidal base (20; 220) relative to said bone anchor (60). 5 2. Ausrichtführung nach Anspruch 1, wobei besagte Zwinge (30) mindestens ein Kanal (45, 46) umfasst und besagte Resektionsführung (50) mindestens ein Befestigungsstab (51, 52) für zusammenwirkendes Aufbauen mit besagtem mindestens einem Kanal (45, 46) beinhaltet.

10. The alignment guide of claim 9, wherein said fixator is a set screw (24; 224) and said slot (23; 223) is threaded for cooperative engagement with said set screw (24; 224). 10 3. Ausrichtführung nach Anspruch 2, weiterhin umfassend mindestens ein Feststeller (41, 42; 254) zur Bewegungssteuerung der besagten Resektionsführung (50; 250) relativ zur besagten Zwinge (30; 230).

11. The alignment guide of claim 10, wherein said collar (30) has a window (47) to facilitate manipulating said set screw (24) in said slot (23). 15 4. Ausrichtführung nach Anspruch 3, wobei besagter Feststeller ein Knopf (41, 42; 254) mit einem Gewindestab (38, 39) umfasst, und besagte Zwinge (30; 230) mindestens eine Gewindebohrung (38, 39) beinhaltet; besagte mindestens eine Gewindebohrung (38, 39) überschneidet besagter mindestens ein Kanal (45, 46) der besagten Zwinge (30), und ist für zusammenwirkender Eingriff mittels besagtem Gewindestab des besagten Knopfes (41, 42) vorgesehen, demnach wird regulierter Kontakt zwischen besagtem Knopf und besagtem mindestens einem Befestigungsstab (51, 52) der besagten Resektionsführung (50) zur Bewegungssteuerung der besagten Resektionsführung (50) relativ zur besagten Zwinge (30) ermöglicht.

12. The alignment guide of claim 1, wherein said motion governor comprises an aperture (37) in said collar (30), and an actuator (40) cooperatively assembled with said aperture (37) to control motion of said collar (30) relative to said spheroidal base (20). 20 5. Ausrichtführung nach Anspruch 1, weiterhin umfassend mindestens einen Vorsprung auf besagter Zwinge (30), mindestens einen Kanal (45, 46) in besagtem Vorsprung, besagte Resektionsführung (50) beinhaltend mindestens einen Befestigungsstab (51, 52); und besagter mindestens ein Kanal (45, 46) zum zusammenwirkenden Aufbau mit besagtem mindestens einem Befestigungsstab (51, 52) angeordnet, und mindestens einen Feststeller, angeordnet auf besagter Ausrichtführung zur Bewegungssteuerung der besagten Resektionsführung (50) relativ zur besagten Zwinge.

13. The alignment guide of claim 12, wherein said actuator (40) is a knob having a threaded extension, and said aperture (37) on said collar (30) is threaded for cooperative assembly with said threaded extension of said knob, thus facilitating regulated contact between said knob and said base to control motion of said collar relative to said base. 25 40 30 35 45 50 55

#### Patentansprüche

1. Ausrichtführung (10) zur Positionierung eines Instruments in Bezug zu einem Knochen, umfassend einen Knochenanker (60) mit ersten Ende (61), das mit einem Knochen (70) verbundenen ist, und mit einem zweiten Ende (62); und einer kugeligen Basis (20; 220) und einer Zwinge (30; 230); wobei besagte kugelige Basis (20; 220) mit besagtem zweiten Ende (62) des besagten Knochenankers (60) verbunden ist; wobei besagte Zwinge (30; 230) mit besagter kugeliger Basis (20; 220) assoziiert ist, um in Bezug zu besagter kugeliger Basis (20; 220) universelle Bewegungen von besagter Zwinge (30, 230) zur Positionierung besagter Instrumente zu ermöglichen; wobei besagte kugelige Basis (20; 220) einen Durchgang (21) für zusammenwirkenden Aufbau mit besagtem zweiten Ende (62) des besagten Knochenankers (60) beinhaltet, **dadurch gekennzeichnet, dass die Führung (10) weiterhin einen Bewegungsregler zur Bewegungssteuerung der besagten Zwinge (30; 230) relativ zu besagter kugeliger Basis** 40 45 50 55

6. Ausrichtführung nach Anspruch 5, wobei besagter mindestens ein Vorsprung (35, 36) mindestens eine Bohrung (38, 39) hat, die 90° bezüglich besagtem mindestens einem Kanal (45, 46) ausgerichtet ist.

7. Ausrichtführung nach Anspruch 6, wobei besagter mindestens ein Feststeller (41, 42) einen mit einem Gewindeschaff (41b, 42b) verbundenen Knopfkopf (41a, 42a) umfasst, und besagter Schaft (41b, 42b) sich durch besagte mindestens eine Bohrung (38, 39) in Kontakt mit besagtem mindestens einem Befestigungsstab (51, 52) erstreckt.

8. Ausrichtführung nach Anspruch 1, wobei besagter Durchgang (21) innerhalb besagter kugeliger Basis (20) aufhört.

9. Ausrichtführung nach Anspruch 1, wobei besagte kugelige Basis (20; 220) weiterhin einen Schlitz (23; 223) beinhaltet, welcher sich mit besagtem Durchgang (21) schneidet, und besagte Ausrichtführung weiterhin einen Fixator (24; 224) in zusammenwirkendem Aufbau mit besagtem Schlitz (23; 223) umfasst, um besagte kugelige Basis (20; 220) relativ zu besagtem Knochenanker (60) zu stabilisieren.

10. Ausrichtführung nach Anspruch 9, wobei besagter Fixator eine Feststellschraube (24; 224) ist und besagter Schlitz (23; 223) für das zusammenwirkende Eingreifen mit besagter Feststellschraube (24; 224) mit einem Gewinde ausgestattet ist.

11. Ausrichtführung nach Anspruch 10, wobei besagte Zwinge (30) zur Vereinfachung der Manipulation besagter Feststellschraube (24) in besagten Schlitz (23) ein Fenster (47) hat.

12. Ausrichtführung nach Anspruch 1, wobei besagte Bewegungsführung eine Öffnung (37) in besagter Zwinge (30) umfasst und mit einem Aktuator (40) mit besagter Öffnung (37) zusammenwirkend aufgebaut, zur Bewegungssteuerung der besagten Zwinge (30) relativ zu besagter kugeligen Basis (20).

13. Ausrichtführung nach Anspruch 12, wobei besagter Aktuator (40) ein Knopf ist, der einen Gewindegelenk hat, und besagte Öffnung (37) in besagter Zwinge (30) mit einem Gewinde versehen ist, für zusammenwirkender Aufbau mit besagten Gewindegelenken des besagten Knopfes, demnach wird geregelter Kontakt zwischen besagtem Knopf und besagter Basis zur Bewegungssteuerung der besagten Zwinge relativ zu besagter Basis ermöglicht.

mité (62) dudit ancre d'os (60), caractérisé en ce que le guide (10) comprend aussi un régulateur de mouvement pour contrôler le mouvement dudit serre-joint (30 ; 230) relatif à la dite base sphérique (20 ; 220) et comprend aussi un guide de résection (50 ; 250) attaché audit serre-joint (30 ; 230).

2. Guide d'alignement selon la revendication 1, où ledit serre-joint (30) comprend au moins un canal (45, 46) et ledit guide de résection (50) comprend au moins une barre d'attache (51, 52) pour la construction coopérative avec ledit au moins un canal (45, 46).

3. Guide d'alignement selon la revendication 2, comprenant aussi au moins un arrêt (41, 42 ; 254) pour contrôler le mouvement dudit guide de résection (50, 52) relatif au dit serre-joint (30 ; 230).

4. Guide d'alignement selon la revendication 3, où ledit arrêt est un bouton (41, 42 ; 254) comprenant un boulon taraudé, où ledit serre-joint (30 ; 230) comprend au moins un alésage taraudé (38, 39) où ledit alésage taraudé (38, 39) coupe ledit au moins un canal (45, 46) dudit serre-joint (30) et est prévu pour l'engagement coopérative avec le boulon taraudé dudit bouton (41, 42) pour faciliter le contact régulateur entre ledit bouton et ladite barre d'attache (51, 52) dudit guide de résection (50) pour contrôler le mouvement dudit guide de résection (50) par rapport au dit serre-joint (30).

5. Guide d'alignement selon la revendication 1, comprenant aussi au moins une saillie sur ledit serre-joint (30) ; au moins un canal (45, 46) dans ladite saillie ; où ledit guide de résection comprenant au moins une barre d'attache (51, 52) et ledit au moins un canal (45, 46) est arrangé pour une assemblée coopérative avec ladite au moins une barre d'attache (51, 52) et où au moins un arrêt est arrangé sur ledit guide d'alignement pour contrôler le mouvement dudit guide de résection (50) par rapport au dit serre-joint.

## Revendications

9. Guide d'alignement selon la revendication 1, où ladite base sphérique (20 ; 220) comprend aussi une fente (23 ; 223), qui croise ledit passage (21) et où le guide d'alignement comprend aussi un fixateur (24 ; 224) dans une assemblée coopérative avec ladite fente (23 ; 223) pour stabiliser ladite base sphérique (20 ; 220) par rapport au dit ancre d'os (60). 5

10. Guide d'alignement selon la revendication 9, où ledit fixateur est une vis (24; 224) et ladite fente (23 ; 223) est taraudée pour un engagement coopérative avec ladite vis (24 ; 224). 10

11. Guide d'alignement selon la revendication 10, où ledit serre-joint (30) comprend une fenêtre (47) pour faciliter la manipulation de ladite vis (24) dans ladite fente (23). 15

12. Guide d'alignement selon la revendication 1, où ledit régulateur de mouvement comprend une ouverture (37) dans ledit serre-joint (30) et où un dispositif de réglage (40) en assemblée coopérative avec ladite ouverture (37) est prévu pour contrôler le mouvement dudit serre-joint (30) par rapport à ladite base sphérique (20). 20 25

13. Guide d'alignement selon la revendication 12, où ledit dispositif de réglage (40) est un bouton, qui comprend un boulon taraudé et où l'ouverture (37) sur ledit serre-joint (30) est taraudée pour une assemblée coopérative avec ladite saillie taraudée dudit bouton, pour faciliter le contact contrôlé entre ledit bouton et ladite base pour contrôler le mouvement dudit serre-joint par rapport à ladite base. 30

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FIG. 1

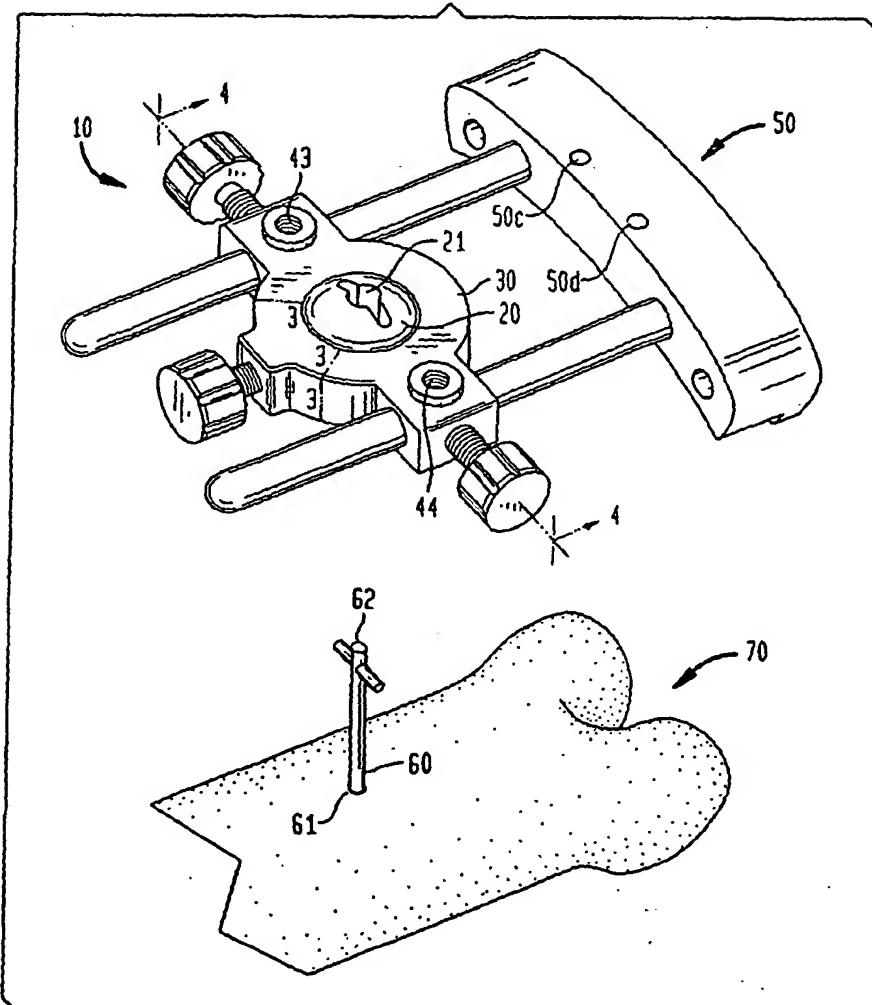


FIG. 2

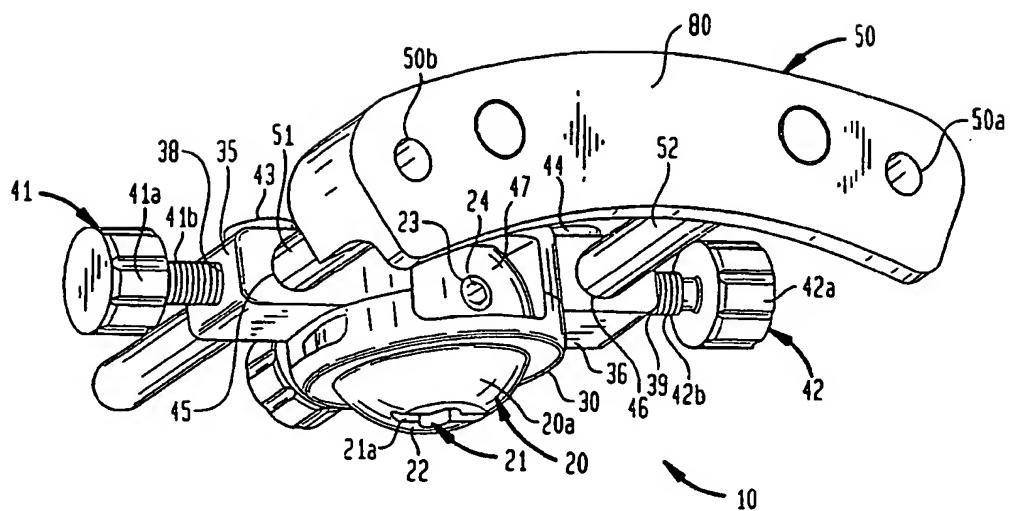


FIG. 3

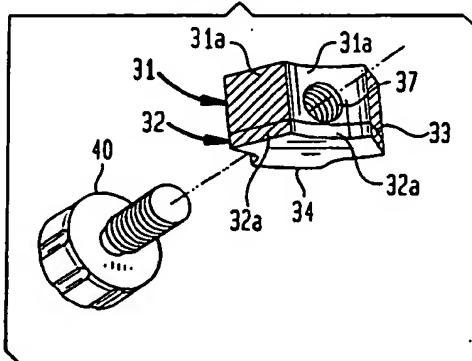


FIG. 4

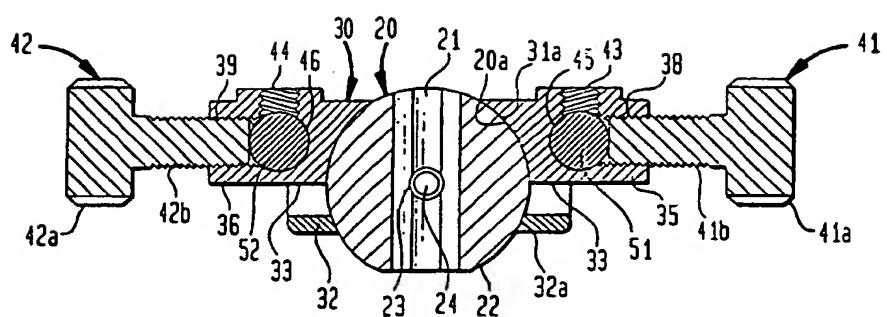


FIG. 5

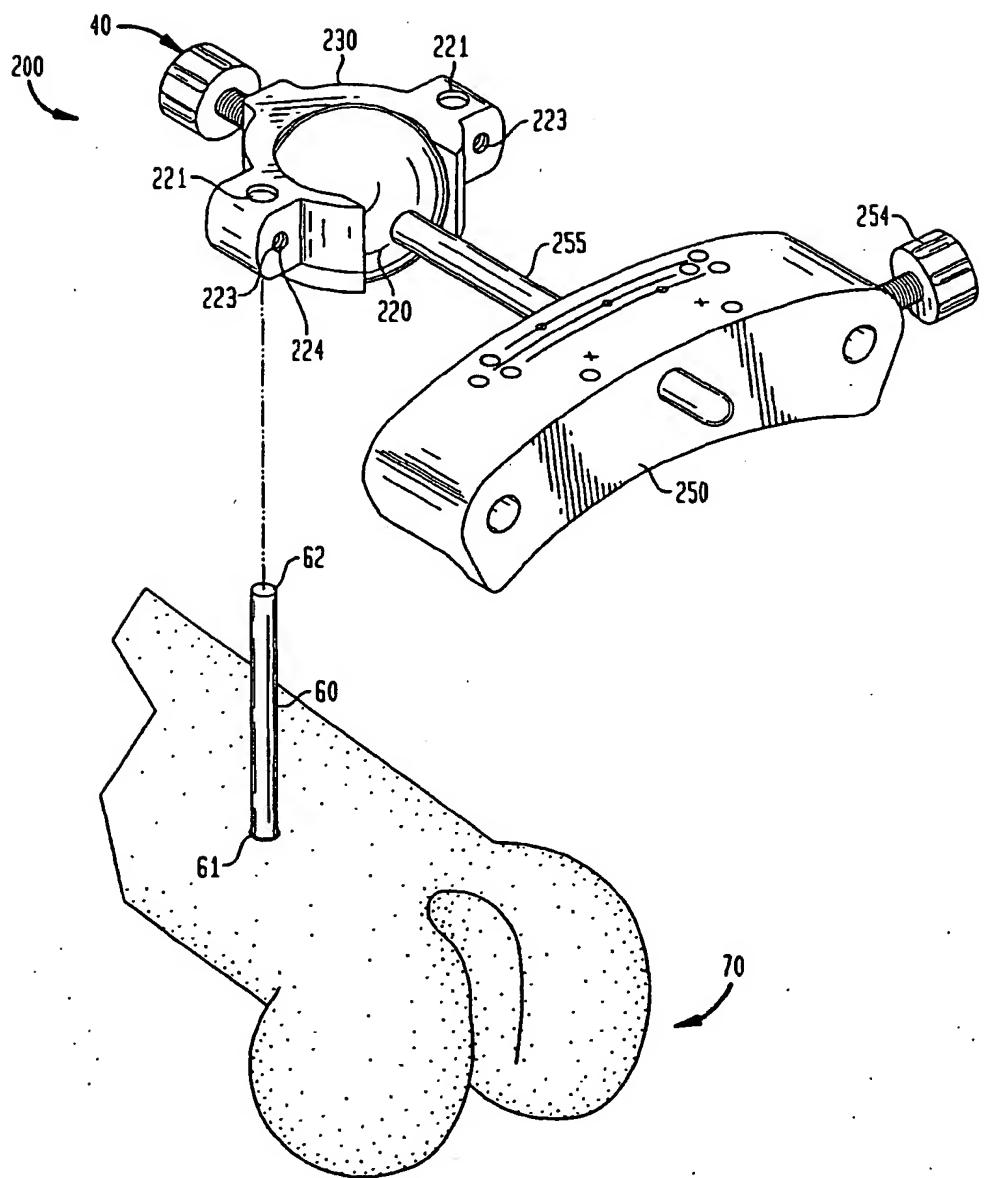


FIG. 6

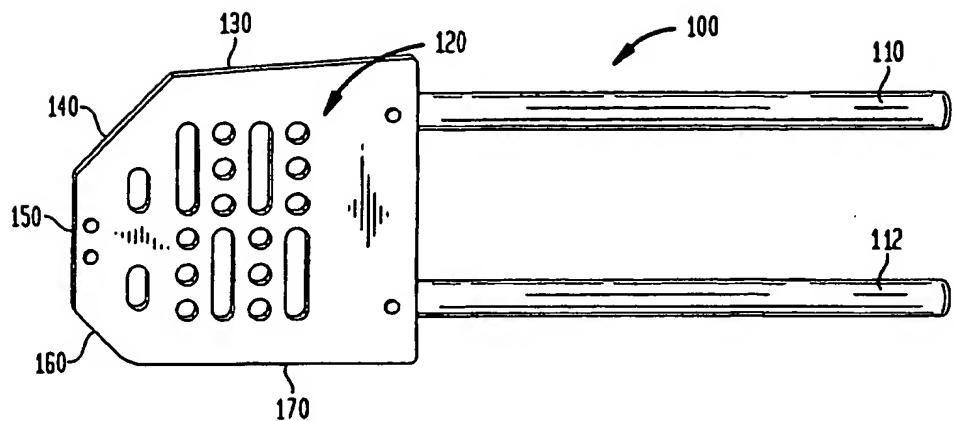


FIG. 7

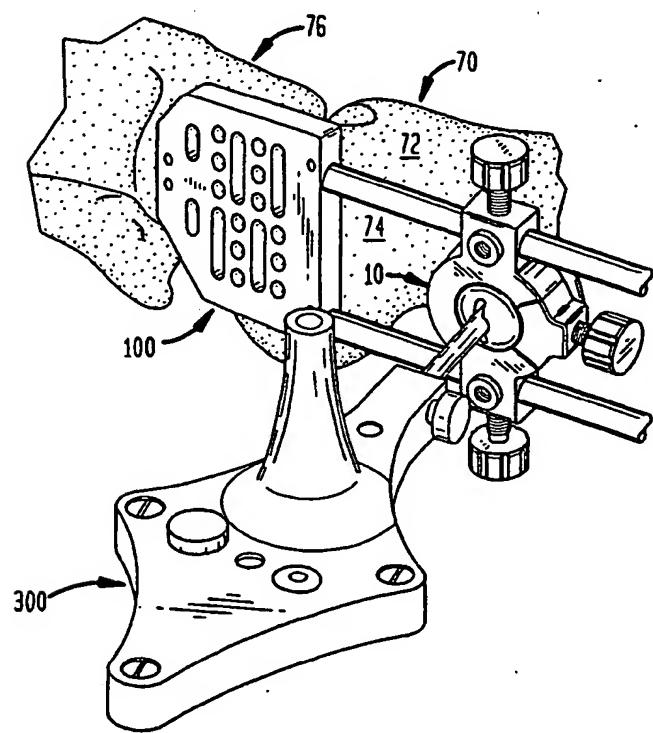


FIG. 8

